Title of Investigation:

Inspiring Blind and Visually Impaired Students with Earth Science

Principal Investigator:

Elissa Levine (Code 923)

In-House Members of the Team:

Sallie Smith (Code 130)

External Collaborators:

National Federation of the Blind (NFB)

Initiation Year:

FY 2004

FY 2004 Authorized Funding:

$20,000

Actual Expenditure of FY 2003 Funding:

In-house: $10,000 for equipment and supplies; Contracts: $10,000 for consultants for teaching and material development

Status of Investigation at End of FY 2004:

Preliminary testing completed and renewal requested to complete project

Expected Completion Date:

December 2005

Purpose of Investigation:

Blind students are discouraged from taking science and engineering-related classes in school or from considering a career in these fields. This is due in large part to the lack of educational materials or technological tools that serve the needs of blind students mainstreamed into traditional public school classes. In this project, hands-on, inquiry-based educational materials from Earth science programs, like GLOBE, were adapted so that blind students could participate in science promoted by the NASA Earth Science Enterprise Mission. By using Earth science as the focus, students used their natural surroundings to learn important concepts and techniques for making measurements. NASA will benefit from this project because it will gain access to the unique abilities that blind students contribute. Likewise, blind students will be inspired to learn science and possibly be motivated to pursue a career with NASA.

FY 2004 Accomplishments:

After a thorough search of available technology and science materials for blind students, we purchased some tools and learning modules to determine their applicability in helping to teach GLOBE protocols and Earth science concepts. Specific GLOBE protocols included the atmosphere/climate, soil characterization, soil temperature and moisture, land cover, and GPS protocols. Materials included talking color analyzers, timers, compasses, maximum/minimum thermometers, calculators, tape measures, and Braille graduated cylinders, compasses, and reading materials. Other materials were designed and created specifically for blind students, including a thermoform of a soil textural triangle and a diagram of soil structure. Some of these materials also were found useful tools for teaching science, math, and technology skills to sighted children. We also obtained existing modules or kits to help teach scientific concepts to blind students and adapted them specifically for an Earth Science investigation. In addition, we contacted Charlie Davis, a plant ecologist, and Dr. Wayne Bell, an ornithologist, to provide guidance for identifying land cover and birds. Materials were collected and developed that students could use for these activities. A special presentation by the National Federation of the Blind (NFB) about working with blind students gave us additional insights into how to best present educational materials.

Twelve blind middle school students tested some of the adapted protocols and materials during the "Circle of Life," a weeklong summer camp co-sponsored by NASA and the NFB. During this camp, students took measurements of air and soil temperature, precipitation, local birds, vegetation type, and some soil properties. Temperature and precipitation measurements were taken daily, starting at the beginning of the week using a GLOBE weather station and talking maximum/minimum thermometers. Dr. Levine and Davis gave special presentations on their respective topics in the middle of the week. At the end of the week, the students spent a day at the Goddard Space Flight Center doing fieldwork and participating in lab and other activities, which tied together the scientific concepts introduced over the week.

Students participating in the camp responded positively to the educational materials and field experience. They showed great interest and were able to grasp complex scientific concepts that may have been difficult without the hands-on approach. In addition, the Goddard team enhanced its knowledge of how to interact with these students and provide appropriate educational materials for them.

We presented and published the following papers:

- Levine, E., "Inspiring Blind Students to Learn Earth Science with GLOBE," 8th Annual GLOBE Conference, July 2004, Boulder, Colorado.
- Feature Story: "Opening Blind Eyes to Science," November 11, 2004, NASA "Life on Earth" Web page, http://www1.nasa.gov/vision/earth/everydaylife/F_Blind_Camp.html

Planned Future Work:

The experience of collecting and developing materials for blind students and the interaction with students at the "Circle of Life" camp laid the foundation for our preliminary work in this project. However, the work will still require additional effort to take it to the next level of production and implementation. The strengths and weaknesses of our approach are clearer and we would like to continue with this work using the insights we have received. Specifically, we need to assure that the students who wish to participate in the program can easily obtain the most effective materials. We need to continue developing teaching aides and strengthen the connection to the GLOBE protocols. Testing with blind children in elementary, middle, and high school classrooms needs to

be done more rigorously. We also need to do another trial of our revamped tools at the NFB "Circle of Life" camp in the summer of 2005.

Summary:

The innovative elements in this proposal are the use of hands-on, Earth science materials for an underserved population—blind students at the K-12 level—and the accessibility of the GLOBE program to blind students. Goddard can benefit from this effort by gaining access to an untapped, underrepresented community. We will know that we have succeeded once we develop the materials and technology, test these materials in the classroom and in NASA's Earth Science Product Review, distribute these materials, and receive a positive response from blind students, who show an increased interest in working in science/engineering fields. Risk factors include the inability to create effective products for blind students, difficulty with teacher implementation, or lack of interest by students.